Upgrading Atari ST Disk Drives

by Steven Lemmen

Over the past year or so Atari has phased out one of it's less popular options, the single sided disk drive. Single sided disk drives were exactly as the name implies, disk drives that only used one side of the 3.5 inch floppy disk for a total of only 360K of capacity versus 720K of capacity for double sided drives, or more if formatted in a non standard manner, but that is a different subject. Though less expensive and therefore in keeping with the "Power Without the Price" slogan, I think the use of the single sided disk drive by Atari was a poor decision and has resulted in a format that restricts alike the owners of the older single sided drive and software developers who must try to support it. The single sided drive used to come stock in the 520ST and as an external drive model the SF354. However the 520ST now comes stock with a double sided drive and the SF354 or any other single sided drive model no longer appears in the Atari ST computer product line, hopefully permanently. The dilemma for the software developers now is whether or not to continue to support the single sided disk format for the userbase of machines with single sided drives or to abandon it completely. When a piece of software occupies 360K or less then there is no problem in releasing the program on one single sided disk which can be purchased and used by owners of both single and double sided drives. The Atari ST operating system has no problem using a single sided disk in a double sided drive but obviously the reverse is not true. However when the software occupies much more storage space than a single sided disk can hold, then those decisions have to be made. Sierra which came out with Manhunter on five single sided disks, where two double sided disks would have sufficed, now only seems to release games in double sided format. For example, Leisure Suit Larry II was three double sided disks, Space Quest III was three double sided disks. Most serious DTP, MIDI, CAD and other business software usually comes in double sided format only. Just think of the implications of supplying all multi disk programs in single sided format. Multiply this by the thousands of software packages, each requiring additional time, cost and handling in the product manufacturing, inventory and end user backup process. Well I really can't blame any software developer who abandons support of the single sided format. Well if you are the owner of a single sided drive, don't despair, you can upgrade it to double sided capacity by replacing the internal mechanism with a commonly available IBM standard type double sided mechanism and possibly some wiring depending on your present equipment type. Details on performing this single to double sided upgrade follow. An alternate method of upgrading an internal 520ST drive to double sided exists and has been done by a few members. This involves buying a complete Atari external double sided drive and then swapping the mechanisms between the internal and external drives. This results in having a double sided A: drive and a single sided B: drive. This is alright in some respects because in gives you a double sided A: to boot double sided software from and a single sided B: to run disk 2 of protected games that use two drives. I think however eventually you would want to upgrade the B: drive to double sided anyway. As long as you recognize the pros and cons, this can be an acceptable interim measure. Now on with the details on double sided upgrades.

You first must purchase a 3.5 inch double sided drive mechanism rated for 80 tracks per side and 10 sectors per track. They are commonly referred to as having a 720K capacity, or alternately some manufacturers refer to them as 800K or 1 Meg capacities. The 1 Meg designation usually refers to the unformatted capacity. Whatever the capacity designation they are the same drive and the formatted capacity depends on the formatting program used. Make sure the drive you buy has the 34 pin ribbon edge connector for the data and control interface and a 4 pin flat connector for the power supply. Do not buy a 1.44 Meg drive mechanism, they are more expensive and the ST disk controller and TOS cannot use the extra capacity of the drive anyway. The drive mechanism I have used successfully is the Teac model

CS-235 which includes a 5.25 inch adapter kit for an IBM type computer which you disassemble and discard. Considering the low cost of about $130 for this drive this is a minor inconvenience and in some cases a benefit because with some early SF-354 drives you need to use the 34 pin edge connector and 4 pin power plug that comes with the adapter kit. Once you have purchased a drive follow the instructions that come with it to set the drive select to D0 even if the mechanism is destined for a B: drive in your ST. Most add on drives you buy come preconfigured for D1 on the assumption you are adding it to an existing IBM type computer which obviously would already have a D0. However the ST does it's drive selecting through cabling so therefore all the drives have to be configured for D0. This is the case with the Teac CS-235. Do not change any other jumpers on the drive, they are for non standard configurations, the ST uses the standard setup.

If you own a 520ST with an internal single sided drive that you intend to replace with the double sided one then first remove the cover. Disconnect the 34 pin ribbon cable and the 4 pin power connector from the existing drive. Then remove the three screws holding the drive in. Note where pin 1 is on the new drive's 34 pin edge connector. It should be marked with a small triangle symbol at one end of the connector. Confirm that it's orientation is correct by tracing it back to the drive's pc board and matching it up with numbering on the board. With the Teac CS-235 the pin 1 marking was incorrect. The manufacturer used a right angle connector to come off the trace side of the board resulting in it being backwards. This doesn't create any problem as long as you are aware of it. Mount your new drive mechanism on the same posts and fasten it with the same screws from the old drive. Watch that the fourth post which has no screw is aligned into the support hole on the drive. Then connect the 4 pin power connector, it is keyed to fit only one way, make note of the orientation. Then connect the 34 pin ribbon cable. Pin 1 on the ribbon cable will be a stripe on one side, this has to match up with pin 1 on the drive. This sometimes will require that the ribbon cable be flipped over. This is the case with the Teac CS-235. If so put a gentle fold in the ribbon cable to accomplish this, do not put undue stress on it. Now you will likely have to cut the disk drive opening on the top cover since the drive mechanism eject button will likely be different from the old one. Just mark it neatly with a straight edge and trim it with an exacto knife. If the drive has an activity light which sticks out and interferes with the cover then break it off flush. The ST has an A: drive activity light on the keyboard so therefore being able to see the one on the drive is unnecessary. Replace the cover and proceed to the section on testing the drive.

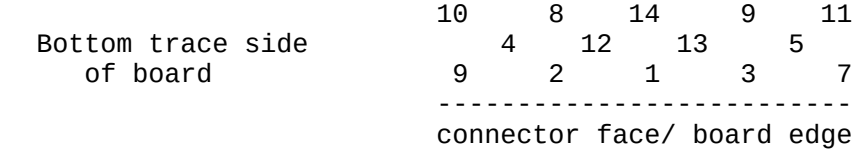
If you own an external drive in which you are replacing the drive mechanism, then open it up to inspect the inside. Inside you should find a small interface board with a single chip microprocessor that adapts the drive mechanism to the ST disk drive interface cable. I have no idea why Atari chose to include this interface because the ST's internal disk drive interface controller chip can handle a single sided mechanism on it's own. This interface prevents you from simply swapping the drive mechanisms to convert to double sided. If you install a double sided mechanism in place of the single, this interface still only allows the drive to operate single sided. This interface board must be modified to overcome this. Check the existing drive mechanism. If it has the same 4 pin and 34 pin connectors as your new mechanism then you need only modify the interface board and plug in the new mechanism. However if you are unfortunate enough to have a drive mechanism that has only a 14 pin flat edge connector and a different 4 pin power connector, then you have the worst disk drive mechanism that Atari has ever sold. You have probably already experienced many read and write operating problems related to this mechanism's extensive alignment problems. The sooner you get rid of this drive the better off you will be. You will have to remove the 34 pin and 4 pin mating connectors off the 5.25 inch adapter if you bought the Teac CS-235 or purchase these items separately if you bought a different mechanism. You will have to splice these mating 4 and 34 pin connectors onto the interface board. This will allow the ST to fully access the new double sided drive mechanism. Details on these wiring

modifications follow.

Use the following table to identify the necessary wiring changes. Cut the traces on the interface board to disable the on board circuitry where noted. For signals that go to the ST cut the traces at the 14 pin DIN connector. For signals that come from the ST cut the traces at the 34 pin drive edge connector. If in doubt cut traces at both ends.

Signal Name	14 Pin DIN to ST	34 pin Ribbon	Old 14 pin edge
Read Data to ST	1	cut trace/ jumper to 30	14 lgt blue
Side Select from ST	2	jumper through to 32	nc
Logic Ground	3	OK - extend to 3	nc
Index Pulse to ST	4	cut trace/ jumper to 8	1 lgt brown
D0 Select from ST	5	cut trace/ jumper to 10	6 blue
D1 Select from ST	6	OK - jumpered through to pin 5 on out DIN	
Logic Ground	7	OK - extend to 7	nc
Motor On from ST	8	OK 16	10 purple
Direction from ST	9	cut trace/ jumper to 18	2 red
Step from ST	10	cut trace/ jumper to 20	3 orange
Write Data from ST	11	OK 22	4 yellow
Write Gate from ST	12	cut trace/ jumper to 24	5 pink
Track 0 to ST	13	cut trace/ jumper to 26	12 white
Write Protect to ST	14	OK 28	13 black

The layout of the 14 pin DIN connector is as follows looking from the bottom of the board.



To prevent motor activity when the ST is off and loading of the ST signals when the drive is off you can add 4.7K pullup resistors and series diodes on the ST side of the Side Select and D0 Select signals. This isn't really necessary since the drive and ST are normally on together but you can add them if it creates a problem for you.

Wire in the new 4 pin power connector if required, the pinout is the same, the old one just can't mate physically. Once you have all the wiring changes complete, reassemble your drive and proceed to testing it.

Now that you have a double sided drive in your computer, you need to thoroughly test it to confirm that it is operating properly. It is always better to uncover faults during a testing period than after you start to work with your valuable data. Boot TOS with a known blank disk. If the TOS desktop does not appear then backtrack, you have made a serious mistake, check all your connections. Once you have TOS then try to format disks in both single and double sided formats and confirm that the format was successful with 360K and 720K of disk capacity respectively. Write and read some files on the disks to confirm that you can retrieve them. Then boot a few of your program disks to confirm that they work. If you can do all of that then it would be safe to assume that your new drive is functioning correctly. If you want to test even more then there are two useful PD drive test programs available from either the club library or as downloads from the BBS. One is a disk speed diagnostic simply called SPEED.PRG. The drive should rotate at 300 RPM plus or minus 5. The other program is called CERTIFY.PRG. This program will read an entire single or double sided disk confirming that each sector is readable without error. This program is also good for checking out the integrity

of disks that may be suspect of giving you problems. Once you have thoroughly tested the disk drive then you are in business with double sided capacity. You will soon wonder how you did without it.

Well now that we all have double sided drives, if only there was some way to backup that single sided software to both sides of a double sided disk to reduce by half the number of disks required to make playing versions. Well actually there is such a device which I constructed and installed in my ST some months ago, but that is the subject of a future article.

Look in the current issue of the G.C.A.C.E. newsletter for an article on installing a switch in your ST to allow the use of one of two operating systems at the flick of a switch. The perfect way to run both TOS 1.0 and TOS 1.4 until all versions of all software have been updated to run flawlessly on TOS 1.4. If you do not get the opportunity to read the GCACE newsletter and are interested in that article, then please inform the editor who can arrange a reprint in the VISTA newsletter.

That concludes this article on ST disk drive upgrades. If you have any questions about the subject matter presented, please do not hesitate to contact me, telephone advice is always free! Well, happy computing, till next time!